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THE SELECTION OF DONORS FOR BLOOD TRANSFUSION, WITH SPECIAL REFERENCE TO THE PRELIMINARY BLOOD TESTS AND THE USE OF THE UNIVERSAL DONOR*

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It may be convenient, during this discussion, to keep before us the constitution of the blood of the four groups with respect to the two iso-agglutinogens A and B and their respective iso-agglutinins anti-A and anti-B.

Constitution of the Human Blood Groups

Serum—	anti-A anti-B	anti-B	anti-A	—
Cells—	O (Universal) (Donor)	A (II)	B (III)	AB (Universal) (Recipient)

Grouping Serums Should Be of the Highest Available Potency

Since it is essential in most cases to determine accurately and promptly the blood group of patient and prospective donors, it is of the highest importance that the grouping serums be of high potency. Each grouping serum should be capable of producing clumps visible to the naked eye in 15 seconds when mixed on the

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slide with an equal volume (one drop each) of a 1:4* suspension of the corresponding cells. If such serums cannot be found among available donors, they should be obtained from the commercial biologic houses.

Some of the commercial serums are colored with methylene blue and eosin. The group II anti-B serum is red, the group III anti-A serum is blue. These colors should remain as standard in order to avoid confusion.

There is no gross difference in the agglutinability of the different group A and the different group B blood cells; thus, a 15-second anti-A grouping serum will clump all group A cells in 15 seconds. However, the 15-second anti-A serum clumps different AB cells at different rates of speed—some samples of these cells requiring as long as 2 minutes before macroscopic clumping is visible. Such samples may not show any agglutination whatever with weaker serums at any time, even microscopically.

Sterility and Stability of Grouping Serums

Grouping serums should be sterile, because certain contaminating bacteria are able to cause the development of non-group-specific agglutinating property in the serums. Sterile grouping serums do not tend to deteriorate over periods of years if stored without preservative.

The Direct Compatibility Test

Patients who require a transfusion of blood are often subjects of abnormal or other conditions (chronic infections, pregnancy, etc.) in which the blood serum sometimes acquires a property of irregular agglutination, which is not group-specific, or may show the property of pseudoagglutination. Since neither of these properties of the patient's serum is of significance in the selection of a donor, it is of importance to the prompt performance of the needed transfusion that the compatibility test be carried out in a manner that will exclude them from action.

A pseudoagglutinating serum exhibits this property best if the test is carried out with the undiluted serum, while auto-agglutination is strongest if the mixtures are iced.

Hence, if the compatibility tests are done on the slide with undiluted serum, or if they are carried out in the test-tube with undiluted serum and read after standing in the ice-box overnight,

* The 1:4 cell suspension is used only in determining the potency of the grouping serums. The grouping of unknown bloods is carried out with 1:20 suspensions.

a resulting pseudo- or auto-agglutination may cause the rejection of a perfectly compatible donor and postponement of the life-saving operation.

These misleading agglutinations can usually be avoided by dilution of the serum in the tests, which may be carried out in the following way according to the suggestion of Dr. Landsteiner. In a small serological test-tube (6x1 cm.) mix two drops of patient's serum, two drops of physiological saline solution and two drops of a 5 per cent suspension of the donor's blood cells (10 per cent of whole blood). A similar mixture is made, in another tube, of donor's serum and patient's cells. The two mixtures are immediately centrifuged at moderate speed for one minute and the sediments are carefully resuspended with as little shaking as is needed to free *all* the cells from the bottom of the tube. If, after all the cells are so resuspended, there are no macroscopically visible clumps the bloods are compatible.

Those wishing to become acquainted with this test will find it helpful to carry it out first with serum and cells which are incompatible.

The Use of the Universal Donor and Other Substitutes for Transfusion of Blood to Patients of Other Groups

It is frequently impracticable, when a blood transfusion is needed, to provide a donor of the same group as the patient and in such a circumstance it is often of critical importance to know what substitutions are physiologically possible.

It has been amply demonstrated that the blood of a universal donor (group O) can be transfused into patients of any of the four groups with wholly satisfactory results, the transfused O cells remaining in the patient's circulation for at least six weeks.

The results are equally satisfactory when donors of the other three groups are used for blood transfusion into patients of the universal recipient group (group AB).

One theoretical consideration has seemed to stand in the way of the indiscriminate use of these substitutions. This is drawn from the reports on the so-called "dangerous" universal donor; that is, a donor the isoagglutinating titer of whose serum is so high that the quantity of his serum which is usually donated in the transfusion (about 250 cc.) could be expected to cause a marked agglutination of all of the recipient's corpuscles. Some doubt has already been thrown upon the actuality of this theoretical danger by an observa-

tion which has been reported in one of the publications from the Blood Transfusion Betterment Association†.

A physician ordered a group O donor for transfusion without stating that the patient belonged to group A. The transfusion was performed without the slightest reaction. By accident it was discovered later that, according to the usual quantitative tests, the quantity of serum transfused should have been sufficient to cause a marked agglutination of all of the patient's red blood corpuscles.

It has seemed most likely that the absence of the expected unpleasant consequences in this case was due to a much lower agglutinating power of the transfused serum at body temperature than at the room temperature at which the "titer" of the serum was determined.

An investigation of this point in the Donor Bureau of the above-mentioned association has been carried out and among the serums of 24 so-called "dangerous" universal donors only 11 were found capable of producing distinct agglutination of 5 parts by volume of the packed cells of the respective incompatible blood. These 11 were derived from a group of about 350 universal donors.

One may conclude, therefore, that about 3 per cent of all universal donors are theoretically ineligible for blood transfusion to patients of other groups.

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† Grove, Ella F.: Jour. of Lab. and Clin. Med., 1931, 16, 670.

EASY APPROACHES TO DETERMINATIVE BACTERIOLOGY*

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Determinative bacteriology, as here considered in its technical aspect, is that part of bacteriological science whereby organisms, not readily recognizable by simpler procedures of stain and cultural characteristics, are emplanted upon carbohydrate and special media, to an end that the results of their bio-chemical reactions may assist in their classification under their proper order, family and species groups.

The immediate object is to show, by successive and logical steps, the materials necessary for this type of work, to clarify difficulties often met, to vision the structure of carbohydrate molecules and the resulting reactions thereon, and to reduce such reactions to a *mathematical scheme* for basic group identification. Strain or species identification will thereby be rendered easier when using a standard book of bacteriological classification. Technologists so often find such a book beyond their capacity.

Arguments *for* and *against* this type of laboratory work are roughly as follows:

1. *against it*—
   (a) the laboratory does little or no bacteriology
   (b) this type of work is *not asked for*
   (c) *clinicians* are *not interested*
   (d) *technologist* is *not* adequately *trained* and is otherwise *too busy*
   (e) it is *too expensive*.
2. *for it*—
   (a) with technologists trained, clinical *interest would be* stimulated and such studies *would be asked for*
   (b) the expense entailed and time expended are negligible in comparison with the *value of results to be attained*
   (c) because of reasons listed under No. 1, much valuable information is inevitably lost to both history and literature.

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* *Read before the American Society of Medical Technologists, at Atlantic City, N. J., June 9, 1937.*

It is an earnest hope that interest may be stimulated in determinative bacteriology, and a scheme is here presented to technologists enabling them to begin anew, a study put aside as too difficult and almost beyond understanding.

There appear to be four (4) major approaches.

I—Basic (and Preliminary)

1. The *manual* approach (or technic), through stain, hanging-drop preparation, microscopy, inoculation, isolation and subculture. It is rightly assumed that anyone attempting this type of work is or will become thoroughly proficient in these manipulations.

2. *Preparation* (or foresight), in having available necessary supplies, prepared stocks of media, stains, sterilized glass, etc.; then complete assembly of everything needed that quiet and concentrated application may be given to the task. Discouragement and failure are the likely harvest due to lack of plan and interrupted technic.

3. *The media*—so fundamental in determinations. It warrants a brief review. Carbohydrates (usually 1%) are used both for enrichment and for basis of fermentation. They may be added to a solid (agar) and then require stab inoculation. If a fluid be used (usually a nutrient broth), an inverted fermentation tube is required. Inoculate moderately by loop. The fluid form seems easier and is less expensive. An *indicator* is imperative. Select one indicator and use it consistently. If it be *phenol red*, the prepared medium is red and *acid reaction* is yellow. If Andrade's be used, the prepared medium is *colorless, alkaline* reaction is not evidenced and *acid reaction is red*. Many find this easier. Grave errors occur from omission of indicator or varying lots of indicator used in the media prepared at different times.

Reaction. pH of media should be slightly alkaline, final at about 7.4.

Sterilization is fractional, by Arnold, for common sugars used routinely. It is important to note that carbohydrates are easily destroyed by heat; overheating splits them into simpler compounds which may be fermentable by organisms unable to ferment an unaltered sugar. Many errors may be laid to overheated media. See standard texts when preparing them.

Amount of media to prepare is dependent on your special need.

The following is suggested for workers beginning the work. It will be about a two weeks' supply and allow for one to three identifications per day, as your needs may vary:

nutrient broth (pH 7.6)	1000 c.c.
indicator (use 1%)	10 c.c. (*don't forget it*)
test tubes	approx. 200
fermentation tubes	

Survey charts of the negative cocci, the streptococci and the Gram negative bacilli and observe that some sugars are used in the identification of all of them. Therefore more tubes of these will be required (ex. lactose, mannite and salacin). Subdivide broth into 50 cc., 75 cc., 100 cc. or even 150 cc. lots and add to these the respective sugars (1%) as the frequency of use will indicate. Fermentation tubes need not be placed in all test tubes, since neither the Gram negative cocci nor the streptococci form *gas*. Reserve fermentation tubes for the bacilli. These tubes should fill during sterilization.

Sugars to prepare. The commoner (and less expensive ones) are usually adequate for routine identifications. Purchase in 10 gm. or 25 gm. amounts. If you do little work, larger amounts may deteriorate or you may discontinue this type of work.

II—The Tube Set-up

1. Have available an isolated, young and pure strain of organism for study. *Never proceed without proving its purity by stain.* Assemble the carbohydrate and other media necessary for determination of that specific organism. Inoculate all tubes, incubate and observe and record results on first, second and even third day as may be required. Make a hanging-drop study for motility on a 24-hour fluid culture; do a stain (Gram usually adequate) and study for spores (if bacilli) and record Gram stain reaction and morphology. It is imperative that all three of these (motility, spores and stain reaction) be known and be accurately recorded before considering sugar reactions. Something of course follows incubation. What *is* the organism?

2. *Understanding the carbohydrate molecules.* In simplest language, carbohydrates are classes of bodies especially prominent as the constituents of plants, are also found in the animal body, either free or as an integral part of various proteins. They are called carbohydrates because they contain the elements of

C H and O

the H and O being present in proportion to form water. They are classed according to the simple carbohydrate groups which they contain, as— mono- , di- , tri- , and polysaccharides. If these be not understood, determinative bacteriology cannot be done correctly.

The Carbohydrates

I. MONOSACCHARIDES
   1. Pentoses, $C_5H_{10}O_5$
      (a) Arabinose
      (b) Xylose
      (c) Ribose
      (d) Rhamnose (methyl-pentose) $C_6H_{12}O_5$
      (e) Ribodesose (desoxypentose) $C_5H_{10}O_4$
   2. Hexoses, $C_6H_{12}O_6$
      (a) Glucose
      (b) Fructose
      (c) Galactose

II. DISACCHARIDES, $C_{12}H_{22}O_{11}$
   1. Maltose
   2. Lactose
   3. Sucrose
   4. Gentiobiose (iso-maltose)
   5. Cellobiose

III. TRISACCHARIDES, $C_{18}H_{32}O_{16}$
   1. Raffinose

IV. POLYSACCHARIDES $(C_6H_{10}O_5)_x$
   1. Starch Group
      (a) Starch
      (b) Inulin
      (c) Glycogen
      (d) Dextrin
   2. Cellulose Group
      (a) Cellulose
      (b) Hemicelluloses
         (1) Pentosans
            Gum Arabic
         (2) Hexosans
            Galactans
               Agar-agar
         (3) Hexo-pentosans
            Pectin

(From Hawk & Bergeim—Practical Physiological Chemistry. 10th ed., Philadelphia, P. Blakiston's Son & Co., 1931.)

In order to understand the chemical reactions likely to occur (and which will be considered later), the following observations are necessary in regard to the structure of these groups. The monosaccharides are classed under two headings—the Pentoses ($C_5H_{10}O_5$) (classed as imperfect because lacking one C), and the Hexoses ($C_6H_{12}O_6$). From these we derive

$C_6H_{10}O_5$
H_2O (plus water)

$C_6H_{12}O_6$ .....monosaccharides
$(C_6H_{10}O_5)_2$
$C_{12}H_{20}O_{10}$
H_2O " "

$C_{12}H_{22}O_{11}$ .....disaccharides
$(C_6H_{10}O_5)_3$
$C_{18}H_{30}O_{15}$
H_2O " "

$C_{18}H_{32}O_{16}$ .....trisaccharides
$(C_6H_{10}O_5)_x$ .....polysaccharides

3. *Reading* the carbohydrate reactions. Bearing in mind that solubility varies with the complexity, that the ***more complex molecules are the less soluble,*** we are prepared to read reactions. If reaction takes place at all, it must occur first in the monosaccharides, beginning with glucose (dextrose). Understand that maybe no sugars at all will be acted upon. This being true, no reaction can *rightly occur* in a disaccharide unless the monosaccharides of which it is composed have also been acted upon.

Example—glucose (dextrose) and galactose are monosaccharides
lactose (disaccharide) contains both the above
therefore, lactose cannot be acted upon unless *both monos* have been; however because of complexity, *lactose* need not show reaction, as happens in the reactions for B. typhii.

Other examples are *maltose* (disaccharide) containing *glucose* and *glucose*); *litmus milk* (containing *lactose and galactose*). In this latter, the reaction may be so slight on the monosaccharide (galactose) as to be scarcely evident, *but* if lactose be acted upon, litmus milk should be *markedly* acted upon. This leads to our next step—

4. *Spotting reactions.* For purposes of *quick spotting,* plan some definite line-up for your tubes and follow that order consistently. Some find the following easy. To the *left end* of row, place *glucose,* and next to it *lactose;* to the *right hand end* place *galactose* and to the *right* of it place *litmus milk.* The other sugars may be placed as you wish, between these. These are the keys to the whole set-up. These being reasonable in their reactions, you have all information necessary to start identification.

III—Mathematical Scheme

Certain points have been previously stressed as imperative, yet may have seemed trivial, but since they are to be given a numerical equivalent, it is obvious there may be no errors in the plan for first groupings. The values to be given are:

motility	32		
spores	16		
Gram reaction	8		
gelatin (*liquefaction of*)	4		
gas (in glucose)	2		
litmus milk (*coagulation of*)	1	(total 63)	
ADD ONE (1) EXTRA POINT		1	64

For this plan, points *must be listed in this order*. Note the first three are under microscopy; the second three are under enzyme and bio-chemical reactions. Every possible combination of reaction (for bacilli) can be worked out with this plan. There is interval for *expansion;* the values given are in order of their *relative importance* in considering an organism, for example—the wide difference in value between a *motile* and *non-motile* organism, or one *with* or *without* spores.

1. *How to use the scheme.* The specific organism being considered (a bacillus) is scored by a *plus* or *zero* opposite each of the six points listed above. Examples—if motile, use a plus; if no spores, use a zero; if Gram positive, use a plus, if Gram negative, use a zero. When all have been scored, ADD UP THE NUMERICAL VALUES OF THE POINTS LISTED AS ZERO AND ADD ONE (1) MORE POINT.

Mathematical example—take a known— B. coli		(score)
Motility	32	+
Spores	16	O
Gram reaction	8	O
Gelatin (*liquifaction of*)	4	O
Gas (in glucose)	2	+
Litmus milk (*coagulation of*)	1	+
ADD ONE MORE POINT		1
Total		29

By the same plan, B. typhii will add to 32 points; the paratyphoids will add to 30 points; B. dysenteriae to 64 points.

Having now the numerical group, all that is necessary for strain differentiation is to consult the index of bacteriological classifications and therefrom trace down the additional sugar and other reactions. There are, of course, several organisms under any one numerical group, but you have found a place, through the index, to begin tracing the organism.

You will find in your text, some organisms listed as both motile and non-motile. The difference in points would be 32. To work this scheme, plan your own method, by chart, card index, or any other method you wish, and gather information for yourself from text on KNOWNS. Determine the mathematical value and record. When you have an *unknown,* consult your mathematical scheme.

The reason for addition of *one extra* point to every score computed, is that some organisms show a positive (plus) for all of the six points listed, as for example, the aerobe—asterosperus, and the anaerobe—vibrio septique. There are no zero scores to add and the group stands at O. Since a material thing cannot be in class or GROUP O, this group is pushed up by addition of 1 point, making it Group 1; others are likewise moved up by 1 point, making 64 groups.

The organisms which are of more frequent occurrence, fall close together, starting with B. cloacae (group 25), and running in order, B. proteus vulgarus (26); B. pyocyaneus (27); flurescens (28); B. coli (29); para-typhoids (30); pyogenes (31) and B. typhii (32). Note that non-motile organisms fall in groups beginning with Group 33; that spore-forming ones fall between Nos. 1 and 16.

Bear in mind that milk reaction (coagulation), may be slow and score may be thrown off by 1 point, but consideration of other points should suggest this possibility. Failure to include the necessary additional 1 point will also cause a like error in the total. Do not have an error of 4 points in the gelatin, which may be due to no growth at all, or testing on ice for the enzyme before reaction has had time to take place. Sometimes reaction is slow, three or more days. There are, however, few instances where this reaction is the major and deciding one to establish the numerical group. In other words, make no errors in readings (or addition either) and the grouping "will work."

IV—Difficulties and Causes of Errors

1. Failure of organism to grow—read as "negative."
2. Mixed culture—failure to isolate a pure culture to start or contamination thereafter.
3. Unrelated reactions, from standpoint of molecule groups (very common).
4. Broken down sugars—deterioration; too much heat.
5. Omission of indicator (very common).
6. Incorrect pH of base medium.
7. Incorrect marking of sugar tubes.

For designation of sugars, use any plan you wish; no one seems perfect. To mark each tube is laborious if you have many set-ups. The pencil markings may rub off or you may forget to mark some of them. Some texts recommend use of various colored beads at the bottom of the tubes, but these are difficult to use when influenced by acid and fluorescent reactions. If colored cotton plugs be used, it is important not to misplace the plugs after drawing them for inoculation. The following scheme of colors is suggested because it offers a wide range of contrasts. All may be derived from dilute aqueous solutions of stains (and ink) available on any laboratory table. The colors are so distributed as not to conflict within the carbohydrate groups.

glucose	plain	mannite	green
lactose	brown	salacin	black
saccharose	red	dextrin	pink
maltose	orange	galactose	purple
levulose	yellow		

The colors may be applied, after sterilization, to *dry* plugs, by brush or by a cotton swab. There is, of course, no relationship between color and the carbohydrate for which used. Use any colors you wish, if there be marked contrast.

Differential and determinative media are not to be confused. The former is used chiefly in plate form, for growths likely to be mixed, that the inhibitory, enhancing, or color differences in cultural growths may show an organism of major interest. Russell's, for example, is a tube medium, used for biological reaction of isolated colonies picked from plate growth.

Our subject may be brought to a close with brief consideration of the cocci. In media, inoculation, line-up and other procedures, there is no real difference in plan or reasoning. Certain sugars are to be used for these, as for the streptococci (Holmen's classification), and the Neisseria (Elser & Huntoon's classification). Bear in mind that these cocci may form acid, but none of them form any *gas*. If gas results, you are probably working with a very small Gram negative bacillus and not a coccus.

Charts of biological reactions may at first suggest conflicts in these classes of organisms, but this difficulty should be soon overcome by weighing the relationship of the organism in its cultural characteristics—size, luster, contour, pigment—and source from whence derived. The reactions of the streptococci may appear identical, but difference is in hemolytic properties, as in the streptococcus pyogenes (*haemolytic*) and streptococcus mitior (non-haemolytic).

There are instances when an organism, culturally and biologically considered, must be further proven by serological reactions, as B. typhii by an immune serum.

Summary

1. Accurate basic technic is imperative.
2. Comprehension of sugar molecules and related reactions thereon must be understood.
3. In marking of sugar tubes, let there be a wide range of contrasts to prevent conflicts.
4. Mathematical evaluation on 6 points relating to the bacilli, will roughly classify them within 64 groups.
5. Such mathematical value being known, an index of standard texts will assist in full identification of unknowns.

TEXTS ON DETERMINATIVE BACTERIOLOGY

Bergey's Manual of determinative bacteriology, Baltimore, Williams & Wilkins Co., 4th ed., 1934 (out of print). (New edition in preparation).

Chester, Frederick D.: A manual of determinative bacteriology, New York, The Macmillan Co., 1901.

Lehman, K. B. and Neuman, R. O.: Bacteriology, especially determinative bacteriology, Volume 1 (Parts A., B.) Technique and general determinative bacteriology. Volume 2, Part 1, General bacteriology. Part 2, Special bacteriology. New York, G. E. Stechert & Co., 1930-1.

Manuals on General Bacteriology—including some references to the subject, but not specially determinative classifications.

Note:—Exhibit presented:—

13 charts (6 in color)

THE SIGNIFICANCE OF DIFFERENT STRAINS OF MALARIA AND MOSQUITOES IN THE EPIDEMIOLOGY OF THE DISEASE

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The large number of variables entering into the dissemination and survival of the malarial parasites makes the epidemiology of malaria more complex than that of probably any other disease. It is a highly endemic disease in many parts of the world. In these localities it is an insidious evil, bringing not only sickness and death but a great reduction in the physical and mental capacities of many persons who are up and about their duties. Many persons in these localities suffer from it from infancy to old age and all are reconciled to the possibility of frequent attacks. In regions of more temperate climate it assumes more of an epidemic form and may vary from year to year in amount and degree of severity. Occasionally a severe epidemic also occurs in an endemic area. Some of these have been very severe. The terrible epidemic which recently occurred in Ceylon killed the entire populations of some villages and in others brought death in a degree entirely comparable with plague, typhus, or yellow fever.

Our knowledge of the disease has proceeded from the simple to the complex, from generalities to a multiplicity of particulars which often look hopelessly unsuited to generalizations. In the days before the causative organisms and transmitting agents were known it was believed that different humours, spirits, or miasmatic influences were responsible, and various theories were spun around these beliefs. With Laveran's discovery of the *Plasmodium* of malaria in the blood and Ross' discovery of its transmission by mosquitoes, a new understanding was given to some of the peculiarities in the epidemiology of the disease. Following the common human tendency for generalizing on insufficient data the explanations of the vagaries in malarial epidemiology were over-simplified at first. Serious errors were committed when the application of these generalizations were made to the attempts at control. Confounding contradictions arose from the observations of different men. If the mosquito transmission had not been capable of clear proof by experiment and observation any theory involving it would have toppled over because of these contradictions. Many of the facts about the biology of the parasites and their vectors, the interrelations of the two, and the

relations of each to man are now better understood. Consequently, much of the contradictory evidence has now been harmonized in the light of this newer knowledge. Many of the contradictions grew out of false generalizations based upon work with one species of mosquito or upon the study of one species under only one type of biological habitat. These disharmonies disappeared with more information about the habits of various species. The effects of climate, geological structure, and of the social and economic aspects explained away many more of them. I wish to discuss today some of the remaining possibilities in reference to the significance of subspecific differences among the parasites and the mosquitoes in the epidemiology of this disease.

After Ross' work with Culicine mosquitoes and avian malaria, and Grassi's work with Anopheline mosquitoes and human malaria it was assumed that all *Anopheles* mosquitoes could transmit human malaria. Stephens and Christophers (1902), however, demonstrated that certain species of *Anopheles* were less important than others. Subsequent investigations by a large number of malariologists have adequately confirmed this view. The next natural generalization, and one which has proved to be erroneous, was the belief that species of *Anopheles* could be classed either as "dangerous" or "harmless." Then a so-called dangerous species was to be combatted under all conditions and circumstances if malaria were to be controlled. Likewise, so-called harmless species could always be disregarded in the control of malaria. The words *species sanitation* came into use and upon that practice was based the hope of control within reasonable bounds of cost. This generalization has not been wholly erroneous, and much good has come from species sanitation. The matter which concerns us here is that it is also subject to exceptions and contradictions.

A similar condition has also obtained in reference to the parasites. After the species of malaria were established on good morphological grounds there was at least a tacit assumption that parasites which were morphologically identical were identical in their physiological characteristics.

I want to point out to you one characteristic of the malarial life-cycle which makes a study of its epidemiology much more complex than that of most diseases. This life-cycle involves three kinds of animals in such a way that all are essential to its continuation. Furthermore, all of these animals are bisexual and consequently are subject to greater chance of variation than are unisexual organisms. Each individual parasite, mosquito, and human being is different genetically from its parents. Let me explain at this point that in the preceding statement an assumption is made that

malarial parasites are governed by the same laws of genetics as are other bisexual organisms. This has not yet been proved in the case of any sporozoon. *A priori,* then, it would seem reasonable to assume that all three of the partners in this tripartite relationship are undergoing genetic change, and that the factors of isolation, selection, and other factors known to bring about change in other organisms would act upon malarial parasites and mosquitoes to produce similar changes. Malariologists have been slow in acknowledging this possibility and hence have been unprepared for recent findings.

The death blow has been dealt by recent findings in Europe to the earlier view that species of *Anopheles* could be divided into harmful and harmless species. It is now known that *Anopheles maculipennis* consists of several races or varieties differing rather widely in their habits and ability to transmit malaria. Considerable controversy has existed over the explanation of the failure of malaria to establish itself in the various parts of Europe where *A. maculipennis* was known to exist following the return of soldiers to these regions from the battlefronts of the World War. Most of the explanation of this phenomenon can now be offered from our knowledge of the races of this species of mosquito. Three of the varieties (*maculipennis, messeae,* and *melanoon*) exceed the others in their numbers and range, and yet they are only exceptionally concerned with the transmission of the disease. Two other varieties (*labranchiae* and *elutus*) have, so far, been shown to be always dangerous vectors even under biological conditions unfavorable to the others. A sixth variety (*atroparvus*) under ordinary circumstances frequents stables and hence is usually of little importance to man but under certain circumstances may enter houses and bite man. It is then able to support small epidemics of malaria.

These different varieties, insofar as they have been tested, have about equal susceptibilities to malaria parasites. They apparently differ in their abilities to transmit the disease by virtue of their different biting habits and their microclimatic requirements. The type variety and variety *messeae,* for example, are capable of transmitting malaria but are probably easily deviated from man when stabled cattle are in close proximity to him. On the other hand, variety *atroparvus* undergoes partial hibernation in northern climates and, therefore, is attracted more to warmed houses.

These races are easily separable at present only on basis of egg pattern. While cross-breeding experiments have not yet been extensively done most of the attempts to secure cross mating have either failed, or if successful have resulted in non fertile eggs. A detailed and historical account of these findings on the races of

A. maculipennis has been given by Hackett and Missiroli (1935).

A similar situation is stated by Swellengrebel and Rodenwaldt (1932) to exist in the Dutch East Indies. Here the variety, *moluccensis*, of *Anopheles punctulatus* is a much more efficient vector of malaria than the type variety. While I am not aware of any case on record in which two varieties of the same species have been shown to differ distinctly in their susceptibilities to malaria, there seems to be no good reason why such may not be the case.

This seems even more probable in view of my own findings with avian malaria and culicine mosquitoes (1929, 1931, 1935). Here it has been clearly shown that susceptibility to the parasite is an inherent characteristic of the individual mosquito. Furthermore this susceptibility is hereditarily transmitted from mother mosquito to her offspring in a simple Mendelian fashion (in the one case where it has been possible to subject it to careful testing). Indirect evidence indicates that the *degree* of susceptibility of the individual mosquito may also be a function of the heredity (Huff, 1934).

If such an explanation holds in case of Anopheline mosquitoes and human malaria it would be quite possible for a mosquito population to change, for example, from one with a low degree of susceptibility to one with a high degree. Such changes would not be expected in countries where the mosquitoes could breed in large numbers during the whole year, for in such cases the number of genes governing a characteristic tends to remain in the same proportion. However, such changes could occur in temperate regions where only a few individual mosquitoes survive the winters. Droughts might bring the same effect. Another important possibility exists today in the chance that mosquitoes may be transported by means of airplane or other rapid conveyance from one faunal region to another. The effects of segregation of certain characteristics by the transportation of a single mosquito or a few mosquitoes would be equivalent to the effects of cold or dry seasons.

Hypothetically, at least, we could have two mosquito populations not differing from each other at all in morphological characteristics and yet being vastly different in their abilities to transmit malaria. Malariologists in Europe should consider themselves fortunate that, so far, they can distinguish their varieties on basis of egg pattern. It would seem to be wishful thinking, however, to believe that such will be the case for all other groups of mosquitoes.

When we turn to the malarial parasites themselves we encounter a somewhat analogous condition. Parasites of the same species and apparently differing in no morphological characteristics are distinct on physiological characteristics. These may be sufficiently

different to warrant the establishment of separate varieties as I have recently done with one of the avian malarias (1937). In this case the strains of *P. relictum* are identical morphologically but differ in every physiological way in which they were tested. The difference may, however, involve only one characteristic, and then we are probably not justified in separating the organisms into varieties. Two examples of this were discovered in the same year. Boyd and Stratman-Thomas (1933) discovered that two strains of *P. vivax* found within a few miles of eath other and differing in no other discernible characteristics from each other, did not give cross-immunity to each other in the human host. Similarly Mulligan and Sinton (1933) showed that as many as five strains of *P. knowlesi* were capable of producing infections in the same individual monkey where as a chronic or latent infection in the monkey with any one of them conferred an effective immunity against the homologous parasites.

Here we have cases of parasites which are distinguishable only on immunological grounds. Whether they constitute separate races, possibly incapable of cross-breeding or whether they are simply manifestations of variations within a variety or species due to sexual reproduction can only be guessed at the present time. However, just as in the case of the mosquito, it is quite logical, and consistent with our general knowledge of heredity, that such differences could be considered genetic in character. If so, we should expect that they would undergo changes during sexual reproduction. Now it is a well-known fact that people living in regions of endemic malaria and having latent infections will continue to have new attacks of the disease, perhaps for the remainder of their lives, and while many of these are due to relapses, we know that the same individuals usually lose their infections within a few years after moving to a non malarious locality. Therefore, individuals in endemic areas probably build up an immunity to one strain of malaria only to suffer from another immunologically different strain. And since there is the possibility that strains of malaria may change genetically in immunological characteristics, man in these areas is being subjected to reinfection by a multiplicity of genetic stocks of parasites. If, on the other hand, these strains of malaria have evolved far enough that they no longer cross breed it ought to be possible for individuals living in a given region to develop eventually an immunity to superinfection to all of the strains, providing the number of these strains is not unreasonably large.

A long and arduous program of investigations lies ahead of us before we can definitely settle many of these points but it is my

confident belief that their solution will finally give to our knowledge of malaria the organization which it now lacks.

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SOME COMMON ALLERGIES

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The term allergy or idiosyncrasy refers to changes in the human organism resulting from hypersensitiveness of body cells to some specific material. While we do not understand the mechanism of this reaction two types apparently exist. The first type is a condition in which the physical make-up of the individual is such that he inherits or acquires a peculiar sensitivity toward certain substances, generally those of a protein nature. In the second type the person displays a sensitivity when he comes into contact with certain types of drugs or other chemicals not necessarily of a protein nature. Fortunately, symptoms of this latter type are often confined to the skin and result in rash or eczema as, for example in the case of poison ivy. The first type leads often to such afflictions as asthma and hay fever.

Allergies are more than occasional phenomena among human beings. While only about 1% of the people have serious allergies, statistically 90% of all adults are susceptible to reactions more or less severe, when brought into contact with proper substances. It is probably the penalty man pays for large variety in his diet. Animals which eat relatively simple diets do not suffer from these reactions, though in many cases they may be developed experimentally in them.

Allergy may be hereditary or acquired. Frequently several members of a family exhibit a tendency to asthma, headaches and other symptoms of allergic reactions though each may respond to a different protein. It is undoubtedly true that tendencies toward sensitizations are inherited. These cases demand more careful and prolonged treatment than the acquired form. When both parents are sensitive 75% of the offspring show this tendency.

Babies may become sensitized to protein of certain foods eaten by the mother, which may result in eczema. This may be a forerunner of asthma or hay fever which develops in later life.

We probably have many examples of acquired allergy. It is not well understood just how a person acquires an allergy. Many of us are mildly allergic to a variety of different proteins. By continual exposure to these substances it may be possible in certain cases to develop rather severe reactions. It is true, however, that a person may be sensitized more easily to a foreign protein or

substance which he contacts relatively infrequently than to the ones in which the contact is relatively more constant. There is a possibility that in some food allergy the intestinal tract allows, at times, protein to get into the blood only partially digested and thus lead to sensitization, or this protein material may enter through the nasal membranes thus causing the allergy.

Food allergies may be differentiated from other types of allergy especially hay fever by the fact that hay fever is generally seasonal, developing when the specific pollen bearing plant is in bloom. Food allergy on the other hand may be manifest the year round or especially during that time of year when certain food products are available.

The symptoms which may be exhibited in cases of allergy vary with the individual and the degree of sensitivity. As has been mentioned they may be manifest as eczema, asthma and hay fever. An individual may appear to have a continual cold which fails to respond to treatment. Rash and hives often result. Headaches (migraine) or intestinal disorders may be shown by others and in the more severe even convulsions may result from contact with the protein.

Undoubtedly many could cite examples of persons who have some allergy. A few cases will be reviewed to indicate the diversity of things to which people are sensitive. Some previous contact with the specific excitant is usually supposed to have occurred before actual sensitivity can exist. This is often hard to trace as this example will show. Two boys became sick very soon after eating a certain patented breakfast cereal. This occurred each time they attempted to eat it. Skin tests proved hypersensitivity to the cereal and differential test showed they were sensitive to flax seed which was one constituent of the cereal. Both patients had previously been treated with flaxseed poultices. These had probably sensitized them. Later they showed food allergy.

A few years ago in our laboratories a student suffered a severe reaction when he was around rabbits. He had to leave the laboratory when animal experimentation involving rabbits was attempted. Contact is not always necessary for this type of allergy to be manifest. The fur or hair of other animals also causes reactions in some people. The cat is a frequent offender, more often than the dog. Horses may cause the conditions in certain people and some women especially, are sensitive to various fur pieces prized so highly for their ornamental qualities. Feathers may also be included in this list.

Perfumes and face powders often produce an effect which is

far from that which is desired. Some face powders contain an orris root base, to which certain individuals are sensitive. Continued use of such face powder by a sensitive person produces far from that wonderful complexion we hear so much about. Certain types of toilet water cause severe dermatitis in susceptible persons.

Perhaps the most common type of sensitization is food allergy. An almost unlimited list of foods has been incriminated. It is possible to find individuals who would be sensitive to any food we might mention. To make things more complicated some are sensitive to more than one food. As an example we find in medical literature the case of a woman who reacted to wheat, corn, eggs, cocoa, tea, soybeans, spinach and oysters.

Many food allergies can be acquired at any time during life by an over-indulgence in specific foods or from the occasional eating of some unusual food. Overloading of the system for a short time by this excess of protein seems to in some cases develop the reaction in the body.

Allergy to milk develops in babies at times from excessive eating of certain proteins by the mother. This leads to rash and eczema in the child. Many examples of babies who are sensitive to the mother's milk and cow's milk are known; they get along very well on goat's milk to which they are not sensitive. Thus it is possible for a baby to become sensitized to certain proteins before birth.

The degree of food sensitization varies greatly in different individuals. I have personal knowledge of one individual so sensitive to eggs that she cannot eat a piece of bread buttered with a knife which has been used to cut a cake made with eggs. This is perhaps an extreme case. Many people have hives after eating strawberries or similar food, some eat small amounts of the food without any discomfort but any great amount causes definite symptoms of allergy.

Hay fever is another typical example of the body's reaction to a specific protein. In speaking of this condition probably more should be included than just the pollens of weeds and flowers, for similar symptoms are manifest by various persons when they contact certain animal emanations, dust, etc. Typical hay fever develops because of an irritation of the mucous membrane of the nose when in contact with pollen of flowers to which the individual is sensitive. These flowers or weeds causing hay fever are usually relatively common, produce large amounts of pollen and in general the pollen is carried by the wind. The plants which cause this condition vary from the grasses, ragweed, goldenrod to certain

type of roses and other flowers which are common in many gardens. Certain people are very sensitive to some of our most common flowers. The control or prevention of hay fever by cutting weeds is a very difficult undertaking because the individuals react almost as vigorously when they come in contact with the pollen from a single plant as when they are placed in a whole field of this specific plant. Thus to absolutely control hay fever of this type it would be necessary to destroy all the plants of this particular species.

Diagnosis of allergies is often difficult because of many complicating factors. As has been mentioned a person may be allergic to more than one substance. In many cases the patient does not know the specific material to which he is sensitive. A few years ago it was necessary for the physician to resort to a system of elimination in an attempt to determine the offending material. Now it is possible to determine in many cases the substance to which the individual reacts by means of skin testing. Pollen extracts are available for testing in cases of hay fever. Extracted proteins from some two hundred foods are also available and can be used. In many cases the first tests are made by a mixture of proteins to determine to which group the individual is sensitive, then by testing each member of the group the specific one is determined.

These tests are made by simply placing a drop of the fluid extract in a small scratch on the skin. If within thirty minutes a large red area develops, the individual is considered to be abnormally sensitive to the proteins in that particular extract. If possible the person should avoid that protein.

Some difficulties arise in skin testing in that all persons having food allergies do not react to this test. In most cases hay fever patients do react. When a failure to react to food proteins is obtained, then elimination diets are suggested. Rowe in his book on "Food Allergy" has given examples of elimination diets which can be followed in order to detect the food causing the allergy.

It is often difficult to treat persons who are allergic. If they manifest allergy to certain food proteins which can be eliminated from the diet without too much inconvenience this probably is the best form of treatment. In some cases of food allergy avoidance of the food for a period of time may decrease an individual's sensitivity to it. In other instances this is of no avail.

Attempts at desensitizations in both hay fever and food allergy have met with varying degrees of success. With some individuals desensitization may be accomplished by properly graduated doses of the protein in question. This is, however, not universally true

for some persons do not respond to this treatment. With hay fever relief is obtained in some individuals if they take protective shots before their particular pollen season. Some individuals become desensitized in this manner, whereas, others are benefitted only for that particular season and no permanent desensitization results.

Many other examples of allergy could be mentioned but in this brief discussion only the more common and interesting ones have been presented.

Rowe—Food Allergy. Lea and Febiger, Philadelphia.

EDITORIAL

The Editorial page in former issues has pointed out the advantages of belonging to the American Society of Medical Technologists. As we are nearing the close of another fiscal year, we again call this to your attention and take inventory of ourselves as members.

Like any worth-while organization, the growth in membership is likewise gradual and continuous. Not being influenced by sensational or other means. The foundation of the American Society of Medical Technologists is securely embedded in the tenets of men and women whose sincerity and determination is evidenced daily in their application to duty.

An organization composed of individuals bound together with the sole intent of self help which in turn is an indirect advantage to all who come under medical care. When workers in clinical, general bacteriological, or commercial laboratories publish articles through the medium of the Journal, experiences and findings of value are exchanged in the true manner of scientists.

What have you done through the past year for the Society? Have you contributed to the Journal? Have you influenced any of your associates to become registered or if registered to become members of the American Society of Medical Technologists? You who are members or non-member registrants consider these points: It is your Society; its growth depends on you; the contributions to the Journal depend on you to a great extent; the size of the Journal and the variety of its contents depend on the membership roll.

While on the subject, we would in addition advise that you participate further in the activities of the organization. Plan a California vacation—attend the sixth annual convention to be held in San Francisco June 13-15, 1938.

BOOK REVIEW

PRACTICAL PHYSIOLOGICAL CHEMISTRY, by Philip B. Hawk, M.S., Ph.D., President of the Food Research Laboratories, Inc., New York City, and Olaf Bergeim, M.S., Ph.D., Associate Professor of Physiological Chemistry, University of Illinois, College of Medicine, Chicago; in collaboration with Bernard L. Oser, Ph.D., and Arthur G. Cole, Ph.D. Eleventh Edition, 968 pages. Bound in washable Sturdite cloth. P. Blakiston's Son and Company, Inc., Philadelphia, Publishers. Price $8.00.

The first edition of Hawk's Practical Physiological Chemistry was published in 1907. The thirtieth anniversary of this well known work has been celebrated by the publication of the eleventh edition. The useful place this work has occupied in the long list of American medical publications and the great popularity it has always enjoyed is attested by its endurance over the period of years and by the reprintings of many of the former editions. This new eleventh edition will be no less popular than former editions. There are probably few medical schools and laboratories that are not thoroughly acquainted with this work.

A comparison of the present with some of the former editions reveals many worthy additions of tests and experiments. The chapters on Vitamins and Deficiency Diseases, Enzymes and Their Action, Endocrine Organs, Protein, Fat and Carbohydrate Metabolism, Salivary, Gastric, Pancreatic and Intestinal Digestion and others have been rewritten because of the many advances that have been made in these and related topics. The same textbook style and the clear-cut, detailed methods of procedure are retained as in former editions. The work has been kept abreast of all the advances in physiological chemistry for the past thirty years and for this the authors are to be heartily congratulated. They have rendered the medical and allied professions a service of distinct merit in giving us such a concise, accurate and thorough presentation of a subject that is both highly useful and interesting and in which we expect to see many valuable advances in the future as we have in the past. The authors deserve many thanks and may their good work continue for years to come.

ABSTRACTS

LUNG PUNCTURE ON LOBAR PNEUMONIA: S. W. Sappington and G. O. Favorite, American Jour. Med. Sci., Vol. 191, No. 2, 1937, pp. 225-234.

Material obtained this way was cultured and typed and the typing was found to agree perfectly with that done on sputum in the same cases. The method is recommended to facilitate early diagnosis and typing when sputum is not available.

BASAL METABOLISM VALUES IN EXOPHTHALMIC GOITRE: I. Bram, Clin. Med. and Surg., Vol. 44, No. 11, Nov., 1937, p. 501.

Some cause of variations in B.M.R. are cited. Accelerated rates occur in a variety of normal and abnormal conditions. Normal readings may also be obtained in Grave's disease during remissions.

THE SIMULATION OF SPIROCHETAL MORPHOLOGY BY FUSIFORM BACTERIA: M. K. Hine, Jour. Inf. Dis., Vol. 61, No. 2, Sept., 1937, p. 198.

The author reports observations on cultures of two species of Fusiformis. They do not substantiate the theory that fusiform bacteria and oral spirochetes are genetically related.

STAPHYLOCOCCUS FOOD POISONING. REPORT OF A SMALL MILK-BORNE EPIDEMIC: H. J. Shaughnessy and T. C. Grubb, Jour. Inf. Dis., Vol. 58, No. 3, 1936, p. 318.

A hemolytic staphylococcus of the albus type was isolated from the milk suspected of causing the outbreak. The organism was found to produce a toxin capable of causing the observed symptoms. The milk was traced to cows with a staphylococcus mastitis.

OBSERVATIONS ON McLEOD'S METHOD FOR CULTURING THE GONOCOCCUS: L. Thompson, Jour. Inf. Dis., Vol. 61, No. 2, Sept., 1937, p. 129.

The author discusses the results obtained in the application of McLeod's method of culturing the Gonococcus in which the organism is grown in an atmosphere of 8-10% CO_2 and colonies are differentiated by means of the oxydase reaction.

AN IMPROVED METHOD FOR STAINING FOR THE DEMONSTRATION OF NEISSERIA IN CELLULAR EXUDATES: B. R. Sandiford, Jour. Path. and Bact., Vol. 55, No. 2, Sept., 1937, p. 467.

A method of combining the Gram and Pappenheim stains is given whereby the advantages of both stains are said to be retained. The Pappenheim reagent is used as the counter stain.

CHANGES IN THE PLASMA AND CELLS DURING EXPERIMENTAL HUMAN SALT DEFICIENCY: R. A. McCance, Biochem. Jour., p. 1278, August, 1937.

The author reports that the osmotic pressure of serum is decreased by the decrease in the concentration of Na and Cl and that this condition is returned to equilibrium by the diffusion of K, Cl and possibly Na ions from the cells rather than by the diffusion into the RBC and their consequent swelling.

Cell volume, haemoglobin and serum proteins are also increased in salt deficiency.

NEW SOURCES OF UREASE FOR DETERMINATION OF UREA: M. Damodaran and P. Sivaramakrichnan, Biochem. Jour., p. 1041, July, 1937.

Comparison of the urea splitting action of various seeds with the conclusion that water melon seeds are a potent source of urease. Unlike the jack bean and soya bean extracts, water melon does not give the abnormally high readings usually found when determining urea of blood or liver.

PULMONARY ACTINOMYCOSIS CAUSED BY AN ACID-FAST SPECIES OF ACTINOMYCES: N. E. Goldsworthy, Jour. Path. and Bact., p. 17, July, 1937.

Report of a case of pulmonary actionomycosis. The acid-fast filaments were demonstrated in the sputum and in material from a lesion in the abdominal wall.

The author suggests that more attention be paid to infections of this type and especially that they be sought in chronic lung infections where tubercle bacilli cannot be demonstrated.

THE ENCAPSULATION OF HAEMOLYTIC STREPTOCOCCI: G. L. Hobby and M. H. Dawson, Brit. Jour. Exp. Path., p. 212, June, 1937.

A description of a method for demonstrating capsules of haemolytic streptococci (mucoid phase) is given.

PHAGOCYTIC ACTIVITY OF CIRCULATING CELLS IN THE VARIOUS TYPES OF LEUKEMIA: M. M. Strumia and Fred Boerner, Amer. Jour. Path., p. 335, June, 1937.

A comparison of the phagocytic activity of the various types of cells. The promyelocyte was the first to show definite phagocytic activity. Monocytic cells show much greater activity than eosinophiles and lymphocytes are never phagocytic.

THE CALCIUM ION CONCENTRATION OF THE SERUM IN ALLERGIC DISEASES: W. B. Sherman and M. Glidden, Amer. Jour. Med. Sci., Vol. 194, No. 5, 1937, p. 674.

Determinations of calcium ion concentration of sera of normal and allergic patients showed no observable difference. Occasionally patients did respond to calcium therapy however, even though no actual deficiency could be demonstrated.

NEWS AND ANNOUNCEMENTS

REGISTRY OF MEDICAL TECHNOLOGISTS
OF THE
AMERICAN SOCIETY OF CLINICAL PATHOLOGISTS

The Registry of Medical Technologists broke all records in the number of applicants for the last semi-annual examinations. Of the 568 original entries there were 69 cancellations on account of illness or other reasons. Of the balance 464 passed the examination successfully and 35 failed. The practical and written tests were held in various parts of the United States and Canada under the direction of 124 clinical pathologists. The total number of Registrants now runs up to the sizable figure of 4467.

Many inquiries reach the Registry from certificate holders who seek post graduate instruction in a particular field of laboratory work. Data are now being secured and a directory assembled where facilities for such studies are available. In this connection a summer course in parasitology is announced by the Rocky Mountain Biological Laboratory, at Gothic, Gunnison County, Colorado, combining a delightful environment in the heart of the Rocky Mountains with instruction by experts in this branch and at a very moderate cost. Those interested may write for details to Doctor John C. Johnson, 26 Price Street, West Chester, Pennsylvania.

NATIONAL

For the information of members desiring to contact committee chairmen regarding the forthcoming convention to be held June 13-15 in San Francisco, we list the following:

Bernice Elliott, 5107 Webster St., Omaha, Nebraska, Chairman Program Committee.

Marie Hess, 1296 29th Ave., San Francisco, Calif., Chairman Local Arrangements Committee.

Mary M. Gorgas, 2916 Steiner St., San Francisco, Calif., Chairman Scientific Exhibits Committee.

It is the announced policy of the Scientific Exhibit Committee that every member of the Society should make an effort to send in an exhibit to the annual convention at least as often as once every five

years. Members are urged to contact their local representatives on this committee at once. Committee: Mary M. Gorgas, 2916 Steiner St., San Francisco, Cal., Chairman; David Silcock, Versailles, Ky.; Sister M. Alcuin Arens, St. Mary's Hospital, Duluth, Minn.; Pearl L. Moorman, Post Laboratory, Ft. Leavenworth, Kans.; Rachel Wales, Mountain Sanatorium, Hamilton, Ont., Canada.

Massachusetts Institute of Technology, Cambridge, Mass., Department of Biology and Public Health, is offering, this summer, two courses: Public Health Bacteriological Methods, June 13 to July 22; Bacteriology, June 13 to July 22. For information write John W. Williams, M.D.

Oklahoma

The Oklahoma Society of Medical Technologists will hold a one-day convention in Tulsa, Oklahoma, May 21st. The honored guest and speaker at the annual banquet will be Dr. Meyer Bodansky, head of the department of Clinical Pathological Chemistry, University of Texas, School of Medicine, Galveston, Texas.

The Oklahoma Society of Medical Technologists have made great strides this year. We have forty-five members of the state society out of the 60 registered technologists in the state as well as 10 student and associate members.

Minnesota

The fall national Registry examinations were record breaking for Minnesota. The anticipations were better than realized as the following will bear evidence. The examinations were conducted (in the State of Minnesota) in the following hospitals with the number of applicants participating as indicated:

Hospital	No. of applicants
St. Luke's, Duluth	13
Mayo Clinic, Rochester	3
Ancker Hospital, St. Paul	9
Midway Hospital, St. Paul	10
Charles T. Miller Hospital, St. Paul	8
Minneapolis General Hospital, Minneapolis	9

At present the interests of the Society are being gradually taken up with the annual convention of the Minnesota Hospital Association and its allied societies. This will occur on May 19, 20, 21 in Minneapolis. The state organization is still in the making, but local groups in the four main sections of the state have been functioning as usual.